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APPLICATION OF FLOWCHART IN TEACHING SIMPLE INTEREST TO SECONDARY SCHOOL STUDENTS; A PANACEA FOR SUSTAINABLE DEVELOPMENT.

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ABSTRACT

Mathematics is an important subject in the life of every student for proper functioning in the society and for sustainable development. There is no subject without an element of mathematics but it is unfortunate that students run away from mathematics as a subject because they find it boring and difficult to understand. This paper examined the use of flowchart in teaching secondary school students as a panacea for sustainable development. It also highlighted the importance of mathematics for sustainable development and the need to use flowchart for teaching and learning to enhance understanding of mathematics. Also the symbols used in flowchart was highlighted and explained. It further examined the importance of flowchart, how to create flowchart and application of flowchart in teaching and learning simple interest to secondary school students. The study recommended among others that teachers should be using flowchart in teaching the students, as it enhances their comprehension and equally shows the relationship between the steps and connecting arrows. This enhances retention as students' recall details from pictures with text for longer time.

Keywords: Flowchart, Simple interest, Teaching, Mathematics, Secondary school students, Sustainable development, Education

INTRODUCTION

Education is an instrument for change and development. For this, any nation that needs to improve and develop on its citizens' knowledge base must pay attention to education in its yearly budget. Onyeachu (2011) describes education as an excellent tool for national development and that sustainable development is greatly achieved through education. Education prepares young people for the challenges of facing the future and making the best of it. It is supposed to help students to discover themselves, nurture their innate abilities and give vent to their God-given talents (Ezoem, 2013).Kundan in (Ugoh, 2008) describes sustainable development as meeting the need of the present generation without compromising the needs of the future generation. It implies that while education meets the need of the present, it does not compromise the need of the future generation.

Education for sustainable development is lifelong process that leads to an informed and citizens having the creative problem-solving skills, scientific and social literacy and commitment to engage in responsible individual and co-operative actions. Education for sustainable development (ESD) allows every human being acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future in Africa. Ikwumelu (2018) opined that sustainability implies continuity, persistence without diminishing while/ sustainable development therefore implies development that does not diminish and at the same time does little or no harm to the environment or society. Education for sustainable development is holistic approach for school management and the curriculum, it therefore requires reflection on what to teach and how to teach in order to:

Clarify and extent the ability of students to think for themselves.

Foster learning that emerges from discovery and is relevant to the learners' life experience.

For the general development and sustainability of any nation, mathematics has central roles to play. A careful look at the new National Policy on Education in Nigeria (2013) reveals the importance attached to Mathematics, the policy places mathematics as a core subject not even elective as mathematics is the corner stone of study of all other subjects. Mathematics is a language that enables man to record his ideas and to communicate such to others

(Madu, 2013). According to her, mathematics aids man to organize and clarify his thought. Mathematics helps us to have a better problem solving skills, it helps us think analytically and have a better reasoning abilities. Analytical thinking refers to the ability to think critically about the world around us. Reasoning is the ability to think logically about a situation. Mathematics is a methodical application of matter. It is so said because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevents chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills.

Odogwu (2012) pointed out that mathematics is used in describing diverse phenomena in both physical and economic situations. Mathematics is the cradle of all creations, without which the world cannot move an inch. Be it a cook or a farmer, a carpenter or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musician or a magician, everyone needs mathematics in their day-to-day life. Even insects use mathematics in their everyday life for existence. Awofala(2012)said that mathematics is the backbone of technological breakthrough. While Chinwoke(2015) emphasized that the importance of mathematics in the scientific, technological and economic development of any nation has made its teaching and learning in secondary school very important. Onyeka (2012) asserted that a layman needs mathematics in counting his articles of trade, money and products.

We might not realize, but actually mathematics is really important in our daily life. Mathematics is a methodical application of matter. Mathematics makes our life orderly and prevents chaos. Mathematics is also the power of our reasoning, creativity, critical thinking and problem-solving ability. Those abilities need basic mathematical skill. Lastly, mathematics is the cradle of all creations. Every technology that we use these days is using mathematics. Mathematics offers rationality to our thoughts, which is why mathematics is important in our everyday life.

In spite of the compulsory status of mathematics in national policy on education (2013) and its attendant importance in scientific and technological discoveries, secondary school students often exhibit poor

disposition towards mathematics (Okigbo&Okeke,2011; Abakpa &Iji,2011). At secondary school level, both WAEC and NECO Chief Examiners have continued to report the continual poor performance of students in WAEC. Students do not like mathematics because they believe that mathematics is boring, uninteresting, difficult, not captivating. Lack of interest in mathematics leads to students' continual failure in mathematics (Kulbir, 2006;Odili, 2006). Thus it is of great importance that mathematics should be presented in such a way that it draws the attention and interest of students so as to increase their love for mathematics which enhances achievement too

Experience says learning mathematics can be made easier and enjoyable if our curriculum includes mathematical activities and games. Mathematics puzzles and riddles encourage and attract an alert and open-minded attitude among students and help them develop clarity in their thinking. Emphasis should be laid on development of clear concept in mathematics in a child so as to avert phobia and seeing mathematics as a difficult subject. The effective teaching and learning of mathematics cannot be achieved without the use of a strategy that captivates and sustain the interest of the students in the classroom and further leads to retention of knowledge acquired. If a teacher fails here, then the student will develop phobia for the subject as he moves on to the higher classes. For explaining a topic in mathematics, a teacher should include pictures, sketches, diagrams and models as far as possible. As it is believed that the process of learning is complete if our sense of hearing is accompanied by our sense of sight. Open-ended questions should be given to the student to answer and he/she should be encouraged to think about the solutions in all possible manners, this will be easier for the students if the question is presented in a flowchart.

Flowchart is a picture of an algorithm using specific symbols to indicate various programming constructs. It is not clear who was the true inventor of flowcharts, but the first standardized documentation on flowchart was first introduced by Frank and Lillian Gilbreth in 1921, the couple presented the graphic-based method in a presentation titled: "Process Charts: First Steps in Finding the One Best Way to do Work", to members of the American Society of Mechanical Engineers (ASME). After that, in

1930s, Allan, an industrial engineer trained some participants in his Work Simplification Conferences in New York. Participants from this conference such as Art Spinanger and Ben Graham then began to use flowchart in their respective fields, which helped propagate the usage of flowchart. Nowadays, flowchart is an important productivity tool, as it can be used in any field such as education, sales and marketing, business, manufacturing, engineering etc.

A flowchart can also serve as a baseline to construct an effective teaching strategy premised on images and illustrations. Such a diagram-driven technique allows teachers and instructors to connect learners with deep silos of extant information, while empowering students to retain the transmitted knowledge through methodical means. Flowcharts are a convenient way of representing a sequence of operations diagrammatically. Their flexibility means that they can be readily adapted to increase the understanding of subjects across the curriculum as they vary the operations and investigate the effects that results. Flowcharts and diagrams help many students remember a sequence of events and recall interactions in a complex process. Flowcharts can be a great way to explore and sense mathematics (Colin, 2017.) Science communicators should consider flowchart and diagrams as important tools for teaching science and mathematical concepts with students of most ages and levels. Flowcharts can help students and readers who learn through seeing to comprehend the relationship between objects or steps as some people can remember details from a picture with text for a longer time than details from prose. Flowcharts are easy to understand for someone even with limited knowledge of the language.

Teachers are encouraged to use flowcharts to complement their teaching. Flowcharts in the classroom are graphical representations of students' thinking processes. It allows students to chalk out their ideas and thoughts in a logical and organized fashion, giving them the freedom to come back and reflect on it. With this method, a student is able to describe a sequence of events or actions in a step-by-step fashion, leading to its outcome. Flowchart can be used to teach varieties of topics in secondary school mathematics such as simple interest, compound interest, proportion etc. but the focus of this paper is on simple interest. Simple

interest is a quick and easy method of calculating the interest charge on a loan. Simple interest is determined by multiplying the daily interest rate by the principal by the number of days that elapse between payments. Simple Interest= $\frac{P \times T \times R}{100}$; where: P=principle, T =number of days between payments, R =dailyinterest rate. Simple interest will be broken down and represented using flow chart

Flowchart

A flowchart is a diagrammatic representation of a set of instructions which must be followed. Flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task. A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. The main purpose of a flowchart is to analyze different processes.

The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields. Flowcharts are used in designing and documenting simple processes or programs. Like other types of diagrams, they help visualize what is going on and thereby help understand a process, and perhaps also find less-obvious features within the process, like flaws and bottlenecks. There are different types of flowcharts: each type has its own set of boxes and notations.

Types of Flowcharts

Sterneckert (2013) suggested that flowcharts can be modeled from the perspective of different user groups (such as managers, system analysts and clerks), and that there are four general types:

- *Document flowcharts*, showing controls over a document-flow through a system. It is commonly used to trace the movement of a document, such as internal memos, payroll information and interoffice mail through a system.
- *Data flowcharts*, showing controls over a data-flow in a system. It is a significant modeling technique for

analyzes and constructing information processes.

- *System flowcharts*, showing controls at a physical or resource level
- *Program flowchart*, showing the controls in a program within a system. It is a graphic representation of an algorithm, often used in the design phase of programming to work out the logical flow of a program. It can also be used in teaching and learning. Program flowchart was used in this write up because it makes use of standard symbols used in flowcharting.

Common symbols used in flowchart

Flowcharts use boxes of different shapes to denote different types of instructions. The actual instruction is written in the box. These boxes are connected with solid lines which have arrowheads to indicate the direction of flow of the flowchart. The boxes which are used in flowcharts are standardized to have specific meanings. Generally, flowcharts flow from top to bottom and left to right. These flowchart symbols have been standardized by the American National Standards Institute. (ANSI).

While using the flowchart symbols the following points have to be kept in mind:

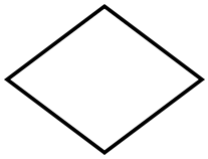
- The shape of the symbol is important and must not be changed.
- The size can be changed as required.
- The symbol must be immediately recognizable.
- The details inside the symbol must be clearly legible.
- The flow lines, as far as possible, must not cross.

ANSI/ISO Shape	Name	Description
→	Flow line (Arrowhead)	Shows the process's order of operation. A line coming from one symbol and pointing at another Arrowheads

are added if the flow is not the standard top-to-bottom, left-to right.

Terminal — Indicates the beginning and ending of a program or sub-process. Represented as a stadium, oval or rounded (fillet) rectangle. They usually contain the word "Start" or "End", or another phrase signaling the start or end of a process, such as "submit inquiry" or "receive product".

Process — Represents a set of operations that changes value, form, or location of data. Represented as a rectangle.



Decision — Shows a conditional operation that determines which one of the two paths the program will take. The operation is commonly a yes/no question or true/false test. Represented as a diamond (rhombus).

Input/output — Indicates the process of inputting and outputting data, as in entering data or displaying results. Represented as a parallelogram.

How to Create Flowchart

While drawing a flowchart, one starts with their first thought or action point and draws it in a box. The remaining action points are placed one by one in boxes in a sequential manner. Arrows connects the boxes in the right order. Ensuring that the boxes are in order is an important element in drawing a flowchart as the idea changes according to the order while flow charting software exists, you can create flow charts using pencil and paper.

Decide on the process to be diagrammed

Before you create a flow chart, brainstorm the process you want to perform and then identify and write down its tasks. The topic that needs to be captured in the flowchart needs to be identified initially.

Identify the start and end of the process
In this step, going through all the steps in a given process and identify their start and end points is important. This helps in structuring the amount of data and detailing that goes into every step.

Activities and steps to complete the process

Why Use Flowcharts in mathematics?
Getting to the one correct answer to a math's problem challenges many students who may not know where to start or how to get to the answer. Flowcharts provide a framework for the mathematics process, giving students a step-by-step approach to tackling the problem. Students are taught how to read flowcharts so the teacher can integrate them into the mathematics curriculum for improved problem solving. The use of flowchart makes teaching interesting and logical, it helps students to remain focused on the topic and it increases their love for mathematics. No matter what role you play in education and mathematics in particular, teacher, student or administrative personnel, you can benefit a lot from using flowcharts to advance mathematics.

At this stage important information to be captured in the flowchart needs to be identified. Arrange the end points in mind. Use arrows to indicate the flow of the process.

Review your flowchart
Involve going through the flowchart one more time and confirming that all activities are captured and recorded in the right order.

The human brain has been adapted to be a pattern finding organism, so putting concepts and ideas into an organized and structured way with flowcharts will aid understanding and learning. They also help overcome information overload and the limitations of temporary memory (i.e. that you can only keep a limited number of thoughts in mind at a moment).

Flowcharts - Enhance Quality of Teaching Plan
Mathematics teachers can break a teaching plan down into smaller sub-processes. The points of each sub process can be discussed in detail on each of a sequence of PowerPoint slides. While trying to develop and remember all teaching contents as a whole might be quite daunting,

developing and remembering what to present about each individual slide is much easier.

Flowcharts – Simplify Ideas and Boost Understanding

describe a complex system. In this way, mathematics teachers can impart knowledge better since students can understand faster.

Flowcharts – Improve Learning Interests

It is said that interest is the best teacher in learning. How to arouse students' curiosity and improve their interests has long been a hard issue. One of the most effective ways is to use infographic materials. Flowcharts can demonstrate things step by step visually, including lines and many vivid pictures showing flows and relations clearly. They can boost students' interests much better than text only. For example, when talking about construction of shapes, students will "get the picture" of order flow at a glance from the following flowchart.

Flowcharts – Help to Involve Students

A good framework to keep in mind is the active training credo:

What I hear, I forget.

What I hear and see, I remember a little.

Flowcharts are used to break complicated mathematics processes down into a series of smaller, more manageable steps. They can be used to schematically

What I hear, see and ask questions about or discuss with someone else, I begin to understand.

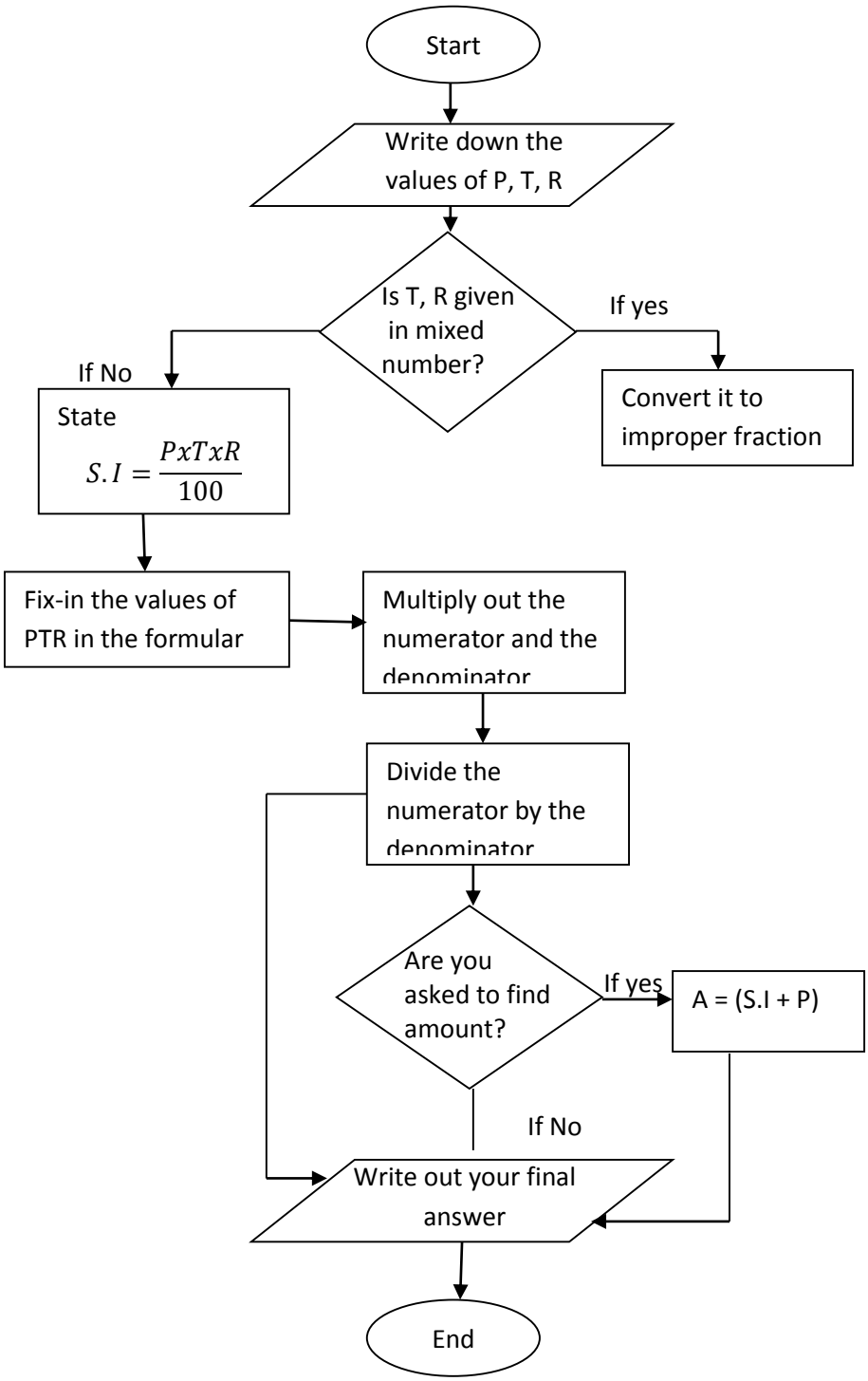
What I hear, see, discuss, and do, I acquire knowledge and skill.

What I teach to another, I master.

A teacher's goal is not just to present knowledge but also to facilitate learners to experience, gain and master knowledge and skills they need in life. By using pictorial flowcharts, teachers can actively involve students.

Use of Flowchart in Teaching Simple Interest in Secondary Schools.

Flowcharts in the classroom are graphical representation of students thinking processes. It allows students to chalk out their ideas and thoughts in a logical and organized fashion giving them the freedom to come back and reflect on it: using this method to teach simple interest will enhance the students understanding of the topic and they will not easily forget because they will easily remember what they see in form of pictures.


Start
Write down the values of P, T, R
Is T, R given in mixed number?
If yes
Convert it to improper fraction
If No
State
$S.I = \frac{PxTxR}{100}$
Fix-in the values of PTR in the formular
Multiply out the numerator and the denominator
Divide the numerator by the denominator
Are you asked to find amount?
If yes
A = (S.I + P)
If No
Write out your final answer
End

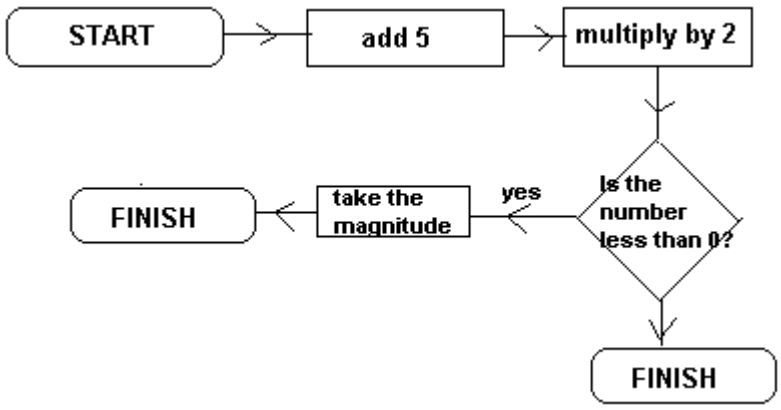
Source: Odiliobi Ogechukwu Justina

From the diagram, the simple interest was simplified, starting from identifying the parameters changing from mixed number to improper fraction, stating of the formula for simple interest, fixing in the parameters in the formula, solving the problem and writing out the final answer while the arrows indicates direction of movement and relationship between the processes in the flow chart.

Use of Flowchart in Teaching Mathematics Topics in Secondary Schools.

When introducing flowcharts for solving mathematics problems, provide the flowchart steps for students. Break down the process for your class so that students will understand how the flowchart works as it relates to mathematics. Start with a simple problem to allow practice working through the flowchart. You might do practice problems as a class. Talk through the process so that students will understand what you are doing. Give the students practice problems using flowcharts with the steps already filled in examples below:

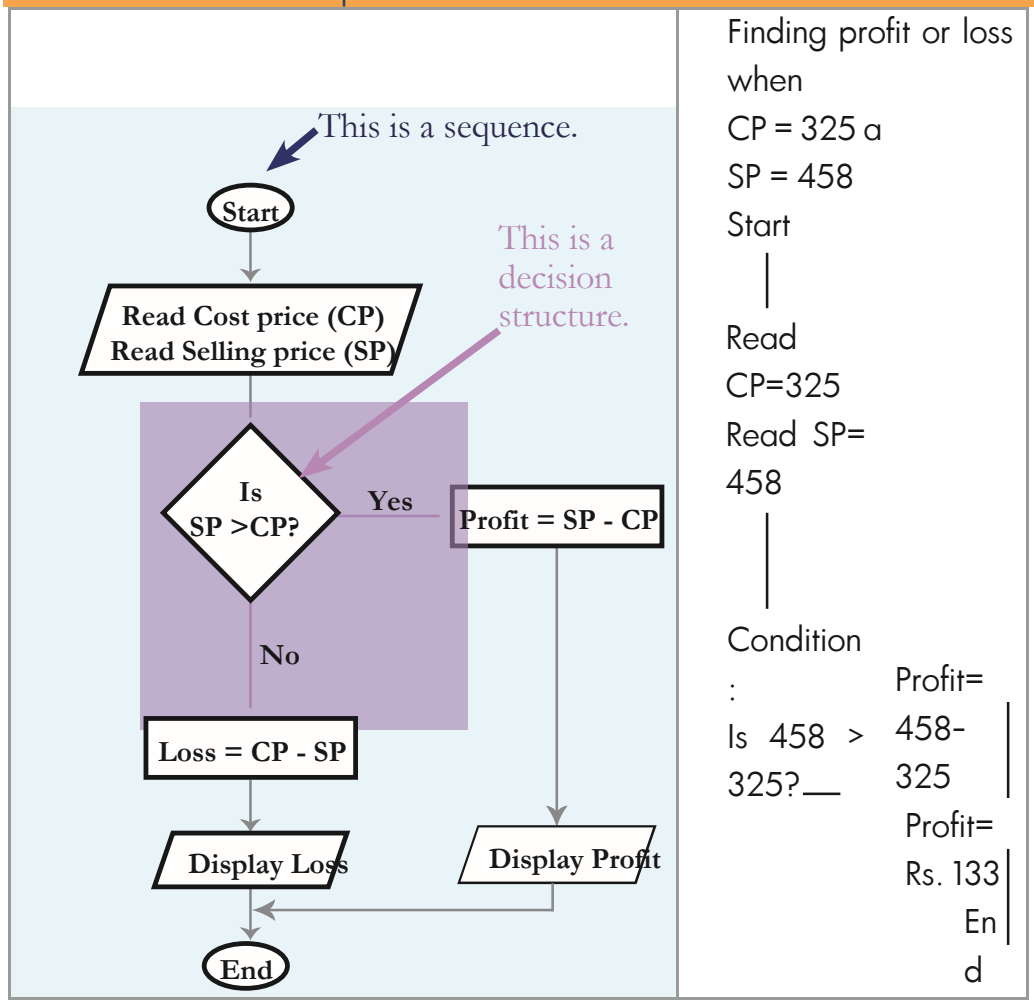
Flowchart for teaching algebra



Source: GCSE (2020)

The flow chart above says think of a number, add 5 and multiply by 2. If the number is negative, make it positive. Flow charts are equivalent to some function. In the example above, the flow chart is equivalent to the function f(X) = | 2(x+5) |. (the vertical lines around 2(x+5) means take the magnitude of the answer).

Flowchart - How to find profit or loss.



Source: Tejas (2018)

The flowchart above is flowchart for teaching profit and loss, once the cost prize and selling prize is given, one weighs the cost prize and selling prize

Lesson plan in Mathematics.
Name of Teacher: Odiliobi Ogechukwu Justina.
Class: J.S.S 3.
Average age: 15yrs.
Number in class: 30
Topic: Simple Interest

Specific Objectives: By the end of the lesson, the students should be able to:

1. Explain the meaning of simple interest.
2. State the formula for finding simple interest.
3. Use flowchart in solving given problems on simple interest and Amount.

Entry Behavior: The students have been saving money and other valuables and also borrowing of money or other items. To assess the student's entry behavior, the following questions are asked.

1. Mention places where you can save money.
2. Where is the safest place to save money?
3. Have you borrowed anyone money before?
4.

Instructional Material: A chart showing a flowchart in Simple Interest.
Skills Emphasized: Set induction, use of example, planned repetition, stimulus variation.

Instructional Procedure:
Activity I: Introduction.
Teachers' activity: The teacher arouses the interest of the students by displaying a chart containing a flowchart on how to solve simple interest, the teacher passes it round for the students to see while she explains the meaning of the symbols in the flowchart, their uses and the steps involved.
Students' activity: The students see, feel and touch the chart and listen to their teacher's explanations.
Activity II: Meaning of Simple Interest.
Teachers' activity: The teacher explains that interest is the payment given for

saving money, that it can also be the price paid for borrowing money. She explains further that when interest is calculated on the basic sum of money saved (or borrowed) it is called simple interest. It is denoted by S. I.

Students' activity: The students pay attention to their teacher, ask questions and jot down.

Activity III: Formula for Simple Interest.

Teachers' activity: With the aid of the chart, the teacher tells the students that simple interest can be calculated using the formula below.

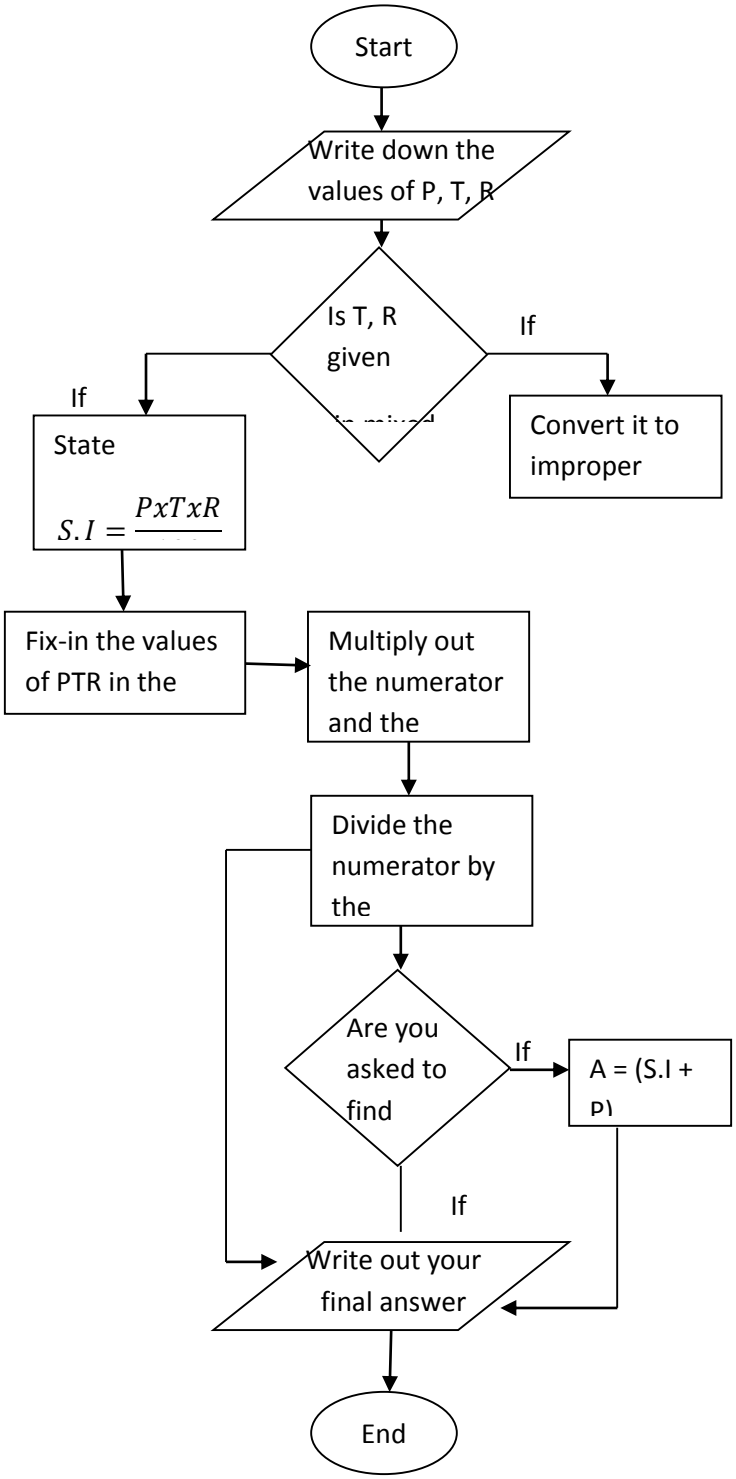
$S.I = \frac{(P \times T \times R)}{100}$ The teacher asks the students to repeat after her and continues by explaining that P is the principal (i.e. the sum of money saved or borrowed) R is the annual rate of interest (given in percentage) and T is the time for which the money is saved (or borrowed).

Students' activity: The students listen attentively to their teacher, observe the chart again, also repeat after their teacher and copy in their notes.

Activity IV: Calculating Simple Interest Using Flowchart.

Teachers' activity: The teacher explains how to calculate simple interest using flowchart step by step with the students as follows:

Example 1: Find the simple interest on ₦12,000 for 7years at 6% per annum.



The teacher asks the students to follow the steps in the flowchart as follows
Step 1: write down the values of P, T, R

P = ₦12,000
T = 7 years
R = 6%

Step II: Are you given the T, R in mixed number? The students answer NO.

Step III: State the formula for simple interest

$$S.I. = \frac{PxTxR}{100}$$

Step IV: Fix-in the parameters

$$S.I. = \frac{12000x7x6}{100}$$

Step V: Multiply out the numerator and the denominator

$$S.I. = \frac{504000}{100}$$

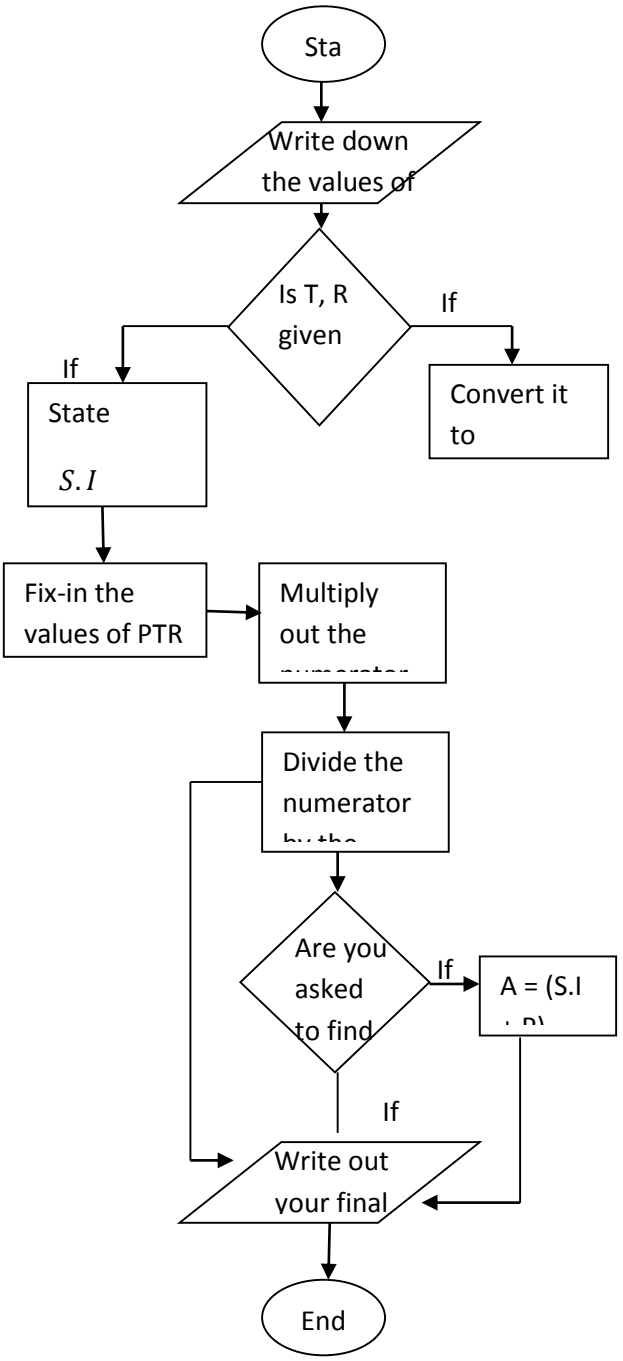
Step VI: Divide the numerator by the denominator

S.I = ₦ 5,040
Step VII: Are you asked to find A?
The students answer: NO

Step VIII: Write out your final answer

S.I. = N 5,040

Example 2: Find the simple interest on ₦3,800 for 4years at $7\frac{1}{2}$ %
Solution: the teacher calls out students to solve using flowchart.



The teacher asks the students to follow the steps in the flowchart as follows
Step I: Write down the values of P, T, R

P = ₦3,800
T = 4 years
R = 7 ½ %

Step II: Are you given the T, R in mixed number? The students answer YES.

Step III: Convert it to improper fraction
R = 7 ½ = $^{15}/_{2}$

Step IV: State the formula for simple interest

$$S.I. = \frac{PxTxR}{100}$$

Step V: Fix-in the parameters

$$S.I. = \frac{3{,}800x4x15}{100x2}$$

Step VI: Multiply out the numerator and the denominator

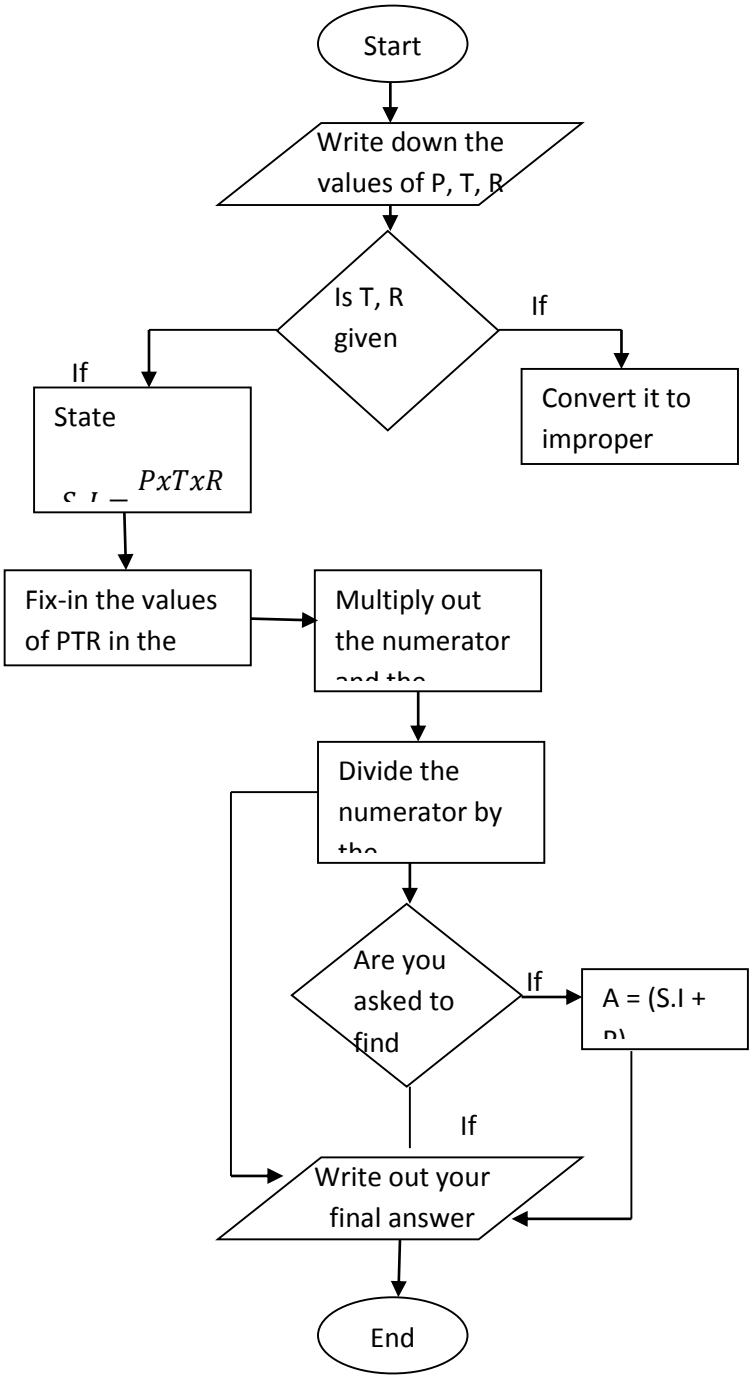
$$S.I. = \frac{228000}{200}$$

Example 3: Find the simple interest and amount of ₦34,320 in5years at $6\frac{1}{2}$ %per annum.

Solution: The teacher calls out a student to solve it using flowchart

Step VII: Divide the numerator by the denominator
S.I = ₦1,140
Step VIII: Are you asked to find A? The students answer: NO

Step IX: Write out your final answer
S.I. = N 1,140



The teacher asks the students to follow the steps in the flowchart as follows
Step I: Write down the values of P, T, R

P = ₦34,320
T = 5 years
R = 6 %

Step II: Are you given the T, R in mixed number? The students answer NO.

Step III: State the formula for simple interest

$$S.I. = \frac{PxTxR}{100}$$

Step IV: Fix-in the parameters

$$S.I. = \frac{34{,}320x5x6}{100}$$

Step V: Multiply out the numerator and the denominator

$$S.I. = \frac{1029600}{100}$$

Step VI: Divide the numerator by the denominator
S.I = ₦10,296

Step VII: Are you asked to find A?
The students answer:YES
Step VIII: A = S.I + P
A = 10,296 + 34,320
A = ₦44,616
Step IX: Write out your final answer
Amount = ₦44,616

Students' activities: The students observe the flowchart closely, answer the teachers question, they also go to the chalkboard to solve questions using the flowchart and they also ask questions for clarifications.

Evaluation: The teacher evaluates the students with the following questions:

1. Explain the meaning of simple interest.
2. State the formula for finding simple interest.
3. With the use of flowchart find the simple interest on the following:
   i. ₦3,000 for 4years at 8%.
   ii. ₦16,000 for 3½ years at 6%.
   iii. ₦2,000 for 1year at 5½ %
   iv.

Students' activities: The students answer the questions in their note books

Summary: The teacher summarizes the lesson by going through the lesson once more emphasizing on the salient points of the lesson.

Closure: The teacher marks the students' books, she commends those that did well and encourage those that did not do well and she also do the corrections with the students

Assignment: The teacher tells the students to practice more question on simple interest using flowchart.

Advantages of using flowchart in teaching simple interest.

1. Flowcharts provide a framework for the mathematics process, giving students a step-by-step approach to tackling the problem with its connected shapes and lines, a flow chart can help students visualize the steps involve in solving problems on simple interest.
2. It arouses the interest of the students because once the flowchart is presented to them, it makes them eager to know and learn the content.
3. Flowcharts are powerful study tool, regardless of the format been used. They make learning simple interest easier and promote better understanding.
4. Flowchart serves as a baseline to construct an effective teaching strategy premised on diagrams.
5. Flowchart empowers students to retain the transmitted knowledge gained in simple interest.
6. It enables students to brainstorm and construct their own knowledge flowcharts, on other mathematics topics.

7. Flowchart enables the students to see the simple interest at a glance and alsohelps the teacher reduce talking and chalking.
8. Flowchart also serves as a visual aid in teaching simple interest.
9. It helps to communicate the steps of the solution of the simple interest to students.
10. It encourages transfer of learning as students who were taught simple interest with flowchart find it easy to write algorithm for computer programmed on mathematics topics.

Flowcharts help to develop a number of skills in the classroom, some of those skills includes: Understanding what a sequence is, understanding the different stages in reaching their answer, understanding the link that the different stages have, and understanding the final answer.

CONCLUSION

From the above we can come to a conclusion that a flowchart is a pictorial representation of an algorithm, an algorithm can be expressed and analyzed through a flowchart. A flowchart uses the help of symbols, shapes and arrows to make the process more logical.Flowchart can be used in teaching varieties of topics in mathematics for easy understanding by the students for sustainable development, it makes mathematics interesting, removes phobia from students, makes lesson interesting and it brings out the best both in the teacher and the students. It also sustains and captivates the interest of the students for a longer time.

RECOMMENDATION

Teachers are encouraged to use flowcharts to complement their teaching for sustainable development.

Teachers should teach their students how to construct flowchart, encourage them for their personal use in mastering mathematics topics.

Workshops, Seminars, conference and in-service training should be organized for teachers and student teachers to broaden their skills on flowchart pedagogical practices that will help them function effectively.

Federal ministry of education and curriculum bodies should include and develop a comprehensive guide for flowchart in mathematics for sustainable development

State government should provide funds to schools for purchase of

computer systems for easy construction of flowchart using Excel, Word, etc. instead of using paper for construction.

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